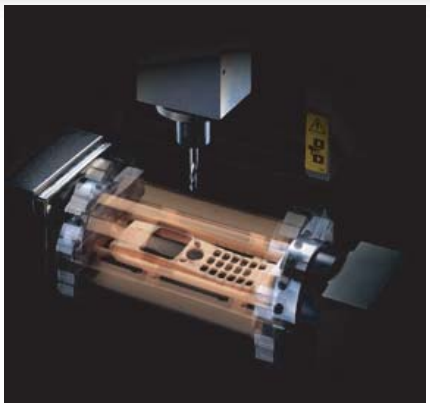
Choosing The Right RP System

New independent study evaluates seven RP systems

This abstract of an RP benchmark study by T.A. Grimm & Associates focuses on the performance of the Roland MDX-650 SRP system. The entire 55-page report is available at www.roland3d.com/benchmark.

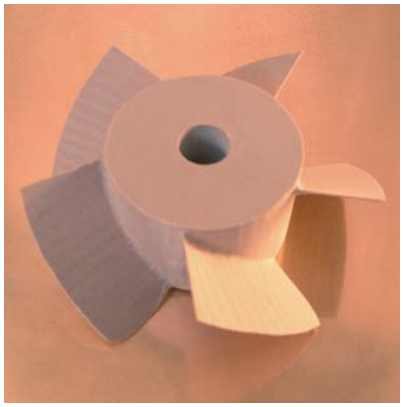


Roland MDX-650 with 4th axis

Have you heard the hype? The rapid prototyping industry is brimming with new technologies. Claims like "fastest processing times," "best surface finish" and "lowest operating costs" practically jump out of magazine advertisements and echo off tradeshow walls.

While design engineers appreciate the new technologies, such vendor claims do little to help them select the right RP system. This complex decision requires going beyond the sales claims to look at a quantitative analysis of product information. After all, some RP systems perform better in specific phases of the design process. Until now, however, such unbiased information was practically non-existent.

In a new benchmark study, Todd Grimm (president of T.A. Grimm & Associates) has examined the attributes of the seven most popular RP systems. The 55-page report offers an independent, detailed account of how these RP systems performed in objective tests. Grimm tested the systems for their ability to handle three typical parts – a mobile phone, a fan and a track ball.



Prototype fan from MDX-650

Prototype cell phone from Z406

Prototype track ball from Dimension

"I produced this benchmark study specifically for design engineers who are trying to select the right rapid prototyping system for their application," said Grimm. "Beyond vendor-supplied data, there is little information about these systems to help companies determine the true performance capabilities of rapid prototyping devices. Without real-world, user-supplied data, this can lead to poor decisions when selecting a system."

Grimm used independent organizations to perform all prototype construction and quality measurements. He displays the findings in 34 charts, five tables and 36 images. Ultimately, the study ranks the seven RP systems by their ability to produce concept models, fit-and-form prototypes, functional prototypes and patterns. Tested products include:

- Z406 from Z Corporation
- QuadraTempo™ from Objet Geometries
- Dimension from Stratasys®
- MDX-650 from Roland
- Viper si2™ from 3D Systems®
- PatternMaster™ from Solidscape
- ThermoJet from 3D Systems

The following information focuses on how the Roland MDX-650 fared in Todd Grimm's benchmark study. The MDX-650 SRP (Subtractive Rapid Prototyping) device lets design engineers mill 3D prototypes quickly and inexpensively. It produces high quality molds in just a few hours.

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Time

Grimm first rates the performance of each device based on time, quality and cost. Chart 1 shows how fast each RP system can produce a finished prototype. The blue lower portion of the bar reflects machine time and the green upper portion reflects all other processes.

Thanks to the speed of AC servomotors and look-ahead technology, the Roland MDX-650 SRP system completed each part in an average of just over four hours. The SRP process might take some more time to set up and program, but it saves time overall by producing parts that are smooth and precise right off the machine. Additive systems, on the other hand, typically require time-consuming post finishing processes.

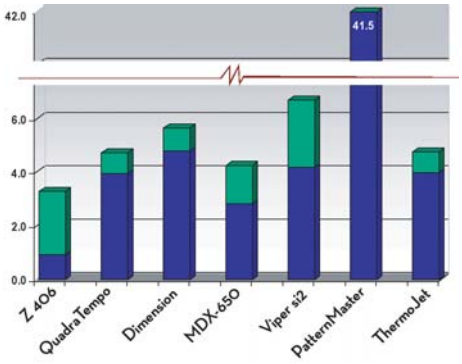

Chart 1 – Average time for the complete prototyping process.

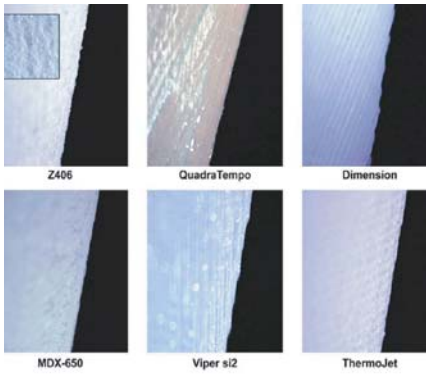

Chart 2 – Surface finish images from the track ball.

Quality

Chart 2 shows the surface finish produced by each rapid prototyping technology. The photos were taken by an independent organization to show a sidewall of the track ball at 10 X magnification.

While the MDX-650 SRP system delivers a smooth surface finish, the additive systems show the telltale stair-stepping effects of layered manufacturing. Layering effects are particularly noticeable for both the Viper si2 and Dimension, which were constructed with 0.15 and 0.25 mm (0.006 and 0.010 in.) layers, respectively.

Cost

Chart 3 shows all annual operating expenses. This includes device acquisition expenses, maintenance contracts, consumables, material disposal, and labor and replacement parts for routine service.

The MDX-650 has the lowest operating expenses thanks to its low acquisition cost, reasonable maintenance cost and wide choice of nonproprietary materials.

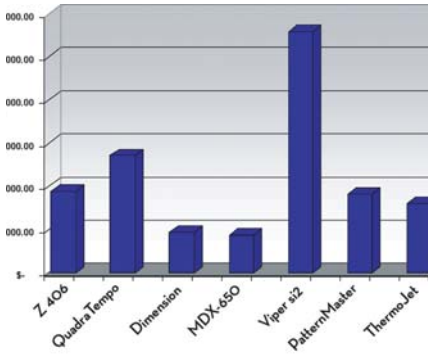

Chart 3 - Annual operating expense including amortized acquisition cost.

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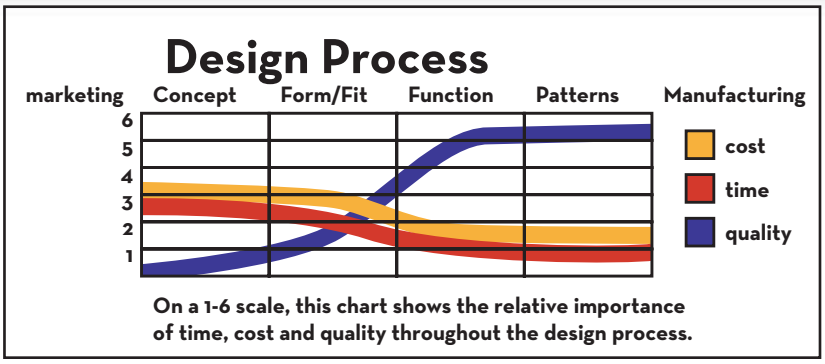
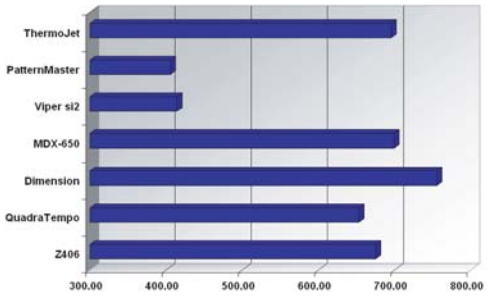
The Design Process often begins with concept and form/fit models and ends with functional prototypes and pattern generation. The Design Process chart shows the importance of time, quality and cost in each of the four phases. Quality, for example, is more important for making patterns and functional prototypes while time and cost are important attributes for producing concept and form/fit models.



On a 1-6 scale, this chart shows the relative importance of time, cost and quality throughout the design process.

The following RP index charts illustrate the effectiveness of the seven RP systems in each phase of the design process. Grimm created the charts by first compiling the averaged data for time, cost and quality. Then, he normalized the results for the concept, form/fit, function and pattern phases on a 1-10 scale and allotted 100 points to 13 factors, such as surface finish and speed.

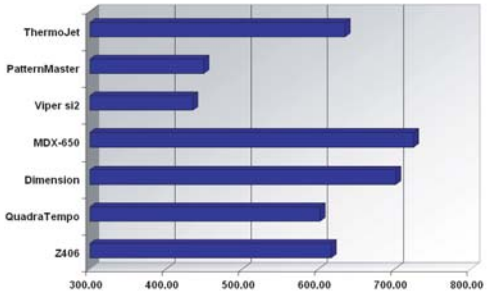
Concept models are produced early in the design process to physically define the shape of the product. Engineers often produce several alternative "looks like" models and use them as visual aids when reviewing the design with marketing and manufacturing colleagues. Needless to say, low costs and fast process times are vital. The MDX-650 earned high marks for its low operating costs, and fast pre-and-post finishing times.



Concept modeling index

Form/fit models are needed when prototypes have two or more pieces that must fit together. Electronic product enclosure prototypes (such as mobile phone housings, hand drill casings and camera bodies) require enough accuracy to test the models' fit for mating surfaces, hole alignment and snap fits.

Superior detail, dimensional accuracy and surface finish are highly desirable attributes for form/fit prototypes. The MDX-650 scores highly for this criteria and gets the job done with a variety of inexpensive materials.



Form and fit modeling index

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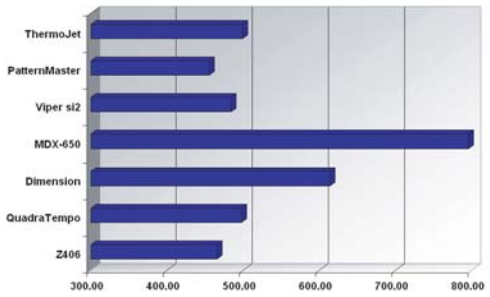
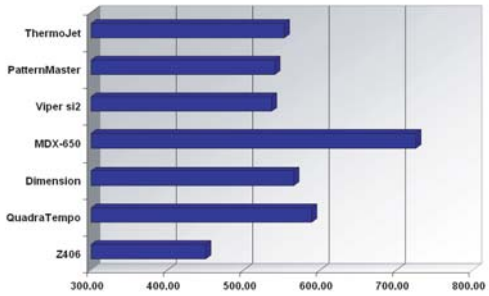
Thanks to its ability to mill a wide range of materials, the MDX-650 is ideal for creating functional prototypes. It lets engineers find out how well products will actually work by milling prototypes of the same material as used in final production. As a result, MDX-650 prototypes can be exposed to a barrage of demanding physical tests. Toothbrush prototypes, for example, must undergo in-vivo testing for hand fit, reach and handle deflection.

The MDX-650 rated extremely high because of its ability to use a wide range of materials. The MDX-650 can often mill the same material used by the actual manufactured part, making it ideal for creating functional prototypes.



Functional analysis index



Pattern generation index

Pattern making, tooling and manufacturing fixtures requires models to be of the best possible quality. The MDX-650 SRP system performed well because it produces parts from a wide variety of materials with the best accuracy and surface finish.

Conclusion: Return On Investment

Roland's MDX-650 earned top honors for producing form/fit, function and pattern prototypes, and came in a close second for making concept models. According to Grimm's study, the flexibility of the MDX-650 shows a beneficial impact across the entire design process when compared to the most popular additive systems. When considering the purchase of an RP system, the MDX-650 is a smart choice. It reduces the entire design process time and helps you get products to market faster, thus maximizing the return on your investment. But don't blindly believe one vendor's claim. Download your own copy of Todd Grimm's benchmark study at www.roland3d.com/benchmark.

T. A. Grimm & Associates, Inc.

Founded by Todd Grimm, a 13-year veteran of the rapid prototyping industry, T. A. Grimm & Associates, Inc. offers consulting services on rapid prototyping and related technologies, including competitive analysis, benchmarking and educational programs. For more information, visit the T. A. Grimm & Associates Web site at www.tagrimm.com.

Roland DGA Corporation

Roland DGA is a worldwide leader in the Rapid Prototyping industry. Major products include MDX Series SRP devices, LPX-250 3D laser scanners and PIX touch probe 3D scanners. Roland DGA headquarters are located in Irvine, CA, with international headquarters in Japan. For more information, please call (800) 542-2307 or visit the web site at www.roland3d.com.